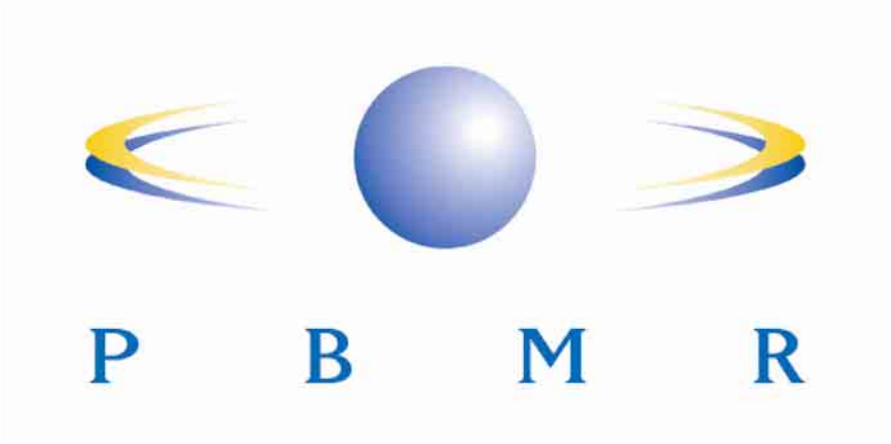


Electrical Systems

Karl Fleming

The PBMR Electrical System consists of the:

- Main Electrical Power System (MEPS)
- Auxiliary Electrical Power System (AEPS)

MEPS Functions

- Converts the generator output to the network voltage and transmits the power to the network
- Accelerates the power turbine generator to synchronous speed during plant starting
- Protects the main power generator and the components of the electrical system by disconnecting these components in the event of an electrical fault
- Measures the electrical power flowing into and out of the generator and the plant

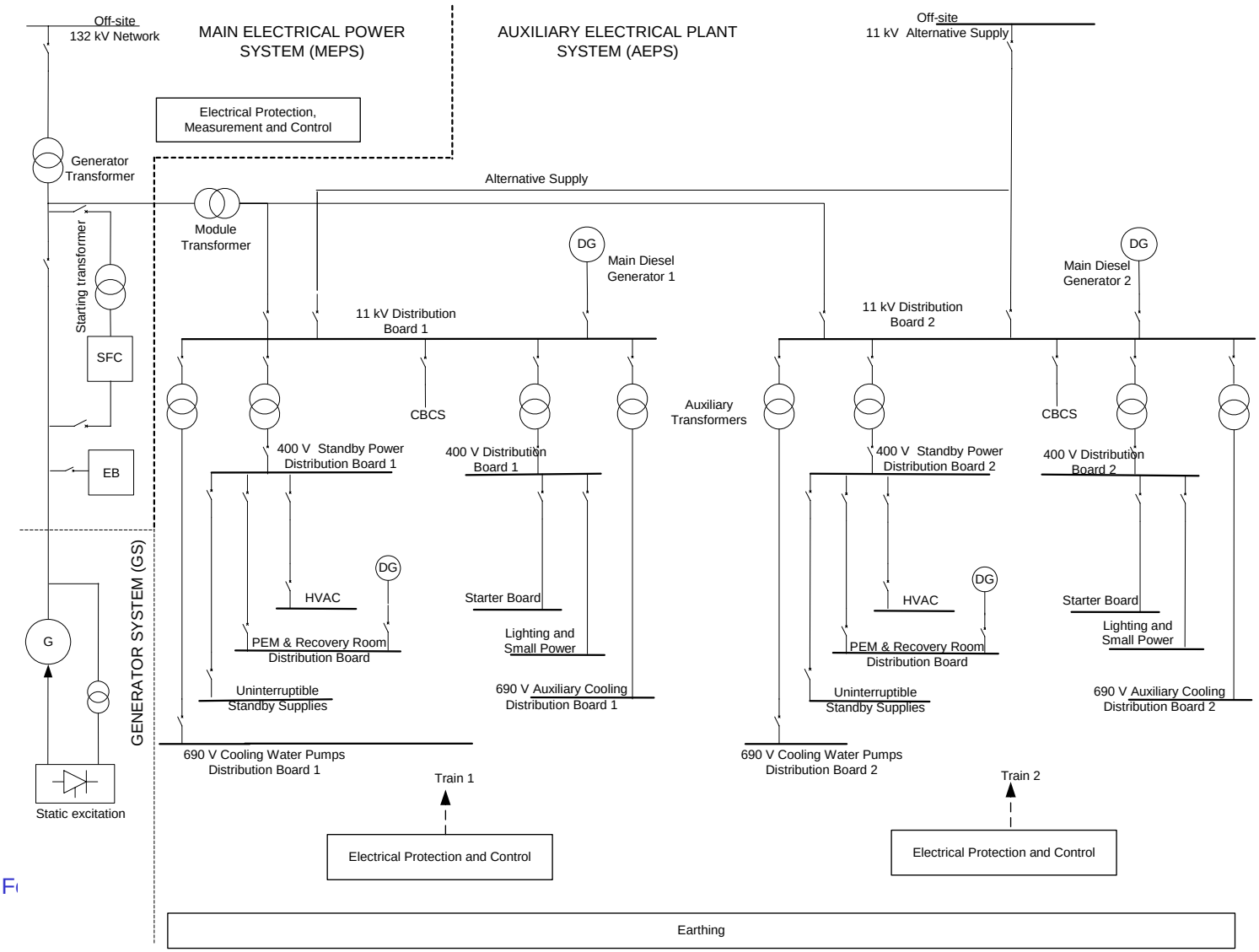
Normal AC Power Sources

- **Off-site power is derived from the following sources:**
  - Koeberg 132 kV high-voltage yard
  - Duyne 132 kV distribution substation
- **PBMR Generator**
  - When PBMR is not producing power, the AEPS can be supplied with power from the Koeberg 132 kV yard through the Generator transformer and the Module transformer. Alternatively, if this supply is not available, power to the plant's auxiliaries can be obtained from the Duyne substation.
  - Power to the auxiliaries can also be supplied from the Duyne substation while the plant is producing power and delivering it to the Koeberg 132 kV substation.

AEPS Functions

- Provides and distributes electrical power to plant subsystem electrical loads (house load)
- Controls the power to the electrical loads in conjunction with the Control and Instrumentation (C&I) System
- Provides back-up power in case of the loss of off-site power
- Protects auxiliary electrical and mechanical equipment against damage due to electrical faults, mechanical overload conditions and lightning strikes

Electrical System One-Line Diagram



AEPS Design Features

Characteristic	Description
House load	7.1 MVA
Power quality	Normal voltage regulation: ± 5% of nominal voltage Short time voltage regulation: ± 10% of nominal voltage (1 h) Power frequency regulation: ± 2% of 50 Hz Short-time frequency regulation: -5%, +3% of 50 Hz (1 h) Voltage unbalance: negative phase sequence ± 1% of positive phase sequence
Motor starting technology	Intelligent motor control with communication bus to control system
Distribution voltages	11 kV, 690 V, 400 V and 230 V
Electromagnetic Compatibility (EMC)	Complies with US Reg. Guide 1.180, EPRI Guideline TR-102323 Rev. 2 and relevant sections of IEC 61000
Main Diesel Generators	Redundant sets Two local fuel tanks of 3 600 l for 12 h runtime Common fuel tank of 9 600 l
Post-Event Monitoring and Recovery Room (PEMRR) diesel generators	Redundant sets Two local fuel tanks of 1 000 l for 24 h runtime

Standby Diesel Generators

- **Two large 11 kV diesel generators are provided, one on each power train. The functions of the standby diesel generators are to provide:**
  - controlled shutdown power; and
  - power for standby supplies during a loss of power to the station.
- **Two small 400 V diesel generators are provided to provide back-up power to the PEMRR and the UPS of the Reactor Protection System (RPS) and Post-Event Monitoring System.**
  - These diesel generators and associated switchgear are seismic qualified.

UPS Components

UPS	Loads
440 V Battery set	Electromagnetic Bearing (EMB) supply (1 h) Oil pump motor supply (1 h) Standby lighting supply (1 h) Reactivity Control System (RCS) and Reserve Shutdown System (RSS) (4 h) Reactor Building access control and radiation monitoring (1 h)
220 V Battery set	Lubrication oil system
110 V Battery set	Electrical protection and control (Circuit-breakers, electrical protection panels, electrical measurement panel, SFC, etc.)
50 V Battery set	Tele-control and communication
C&I UPS	C&I
Services Building UPS	Access control and radiation monitoring Standby lighting in control room and radiation monitoring area
RPS and PEI UPS	Reactor protection and post-event monitoring
PEMRR UPS	Lighting for PEMRR and its diesel generators
Cooling Water C&I UPS	C&I in the Cooling Water (CW) substation